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Educational Resources in a School Health Service

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Editor's note: This is the second in a series of articles in the field of health education by the same author. The first of these appeared in the February issue.

CONCEPTS AS TO the nature and scope of school health service in public and private schools have undergone many changes in recent years. To what extent the school physician and nurse should participate in the educational program of the school is still a moot question with most educational authorities. Most agree, however, that a much greater appreciation for health service exists in the schools today than ever before.

Changes in modern educational philosophy have had a marked effect on the role of the school health worker and his relationship to the educational program of the school. If one may judge from recent trends in this field, it becomes apparent that the health service is becoming accepted as an integral part of the entire educational program. Of utmost significance is the manifest tendency in some school systems to make the aims and objectives of school health service a part of the objectives of all education. The attitude of the school is unquestionably changing to one of full co-operation in efforts being made today to improve child health.

Disharmonies in Child Life

THERE IS an increasing tendency today — in both educational and school health circles — to regard each child as a growing, developing, dynamic human organism, an organism which is itself undergoing rapid change and which is continually endeavoring to adapt itself to a new and ever-changing environment. This environment is far more complicated today than ever before.

Because of the rapidity with which children progress, and the host of adjustments which they must make during the school age period, there arise a multitude of disharmonies some which may serve to thwart the very purpose of education unless corrected. The vast majority of them are physical in nature and concern the child in his everyday relationships with the home, school, and community. Others are emotional. Disharmonies between the natural self and the social self may occasion many of the problems which later find their way to the juvenile courts, institutions for the mentally deranged, and occasionally to penal institutions. Failure by the child to make proper adjustments with environmental factors such as pathogenic bacteria (and protozoan parasites), poisons, foods, and mechanical hazards may nullify all efforts of society to conserve and protect him during his formative years. Eternal vigilance by properly constituted health authorities would to a considerable extent alleviate and undoubtedly forestall much of the existent harm befalling childhood in this country.

If education would find out what each

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child can do comfortably within the limits of his physical and mental ability, then it must, it seems, provide within the confines of the school a functional organization which is capable of anticipating these disharmonies between the child and his environment and which will take steps to set machinery in motion leading to the correction or alleviation of the conditions discovered.

WHILE THE school conceived of its function as simply imparting a given block of subject matter to children the job of the school health worker was necessarily of an ancillary nature. He remained an appendage with little relationship to the educational program. His function was largely the control of communicable diseases and the detection of physical defects.

Today, however, the school physician, dentist, nurse, and dental hygienist face a much different situation. School superintendents, aware of the changes aforementioned, are seeking health personnel whose training and background fit them for health guidance and educational activities as well as health service. The **service** aspect of school health work is thus being interpreted in a much broader sense than before with particular reference to its contribution to the total program of health education.

The Health Examination as a Means of Teaching Hygiene

IT IS GENERALLY recognized today that **the school health examination has health education as its major objective.** It is an experience which for the vast majority of children is both novel and interesting. As a means of teaching hygiene and offering a basis for health guidance, it possesses unlimited possibilities, providing that the school physician, nurse, teacher, and parent willingly assume their responsibilities in making it worthwhile.

Thus far the elementary school has led the way in demonstrating the values to be derived from a well-planned health examination program. By departing from time-worn practices of medical and nursing inspection and substituting a program which called for participation by teachers, parents, and students, it has shown that health service can be a potent means of influencing health practices of school children. Correlation of classroom activities with the events entering into the health examination program has served to broaden the understanding of everyone. The classroom teacher now finds herself a definite part of the health program. Her opportunities to observe the student's health behavior during the school year places her in a most strategic position. Parents are invited to school to both witness the health examination of their children and to take an active part in the program of health guidance advised by the school physician. In this way everyone concerned with the child is in a position to give intelligent co-operation because of a common understanding of the problems involved.

AS FOR THE secondary schools, the vast majority have yet to demonstrate that health can be successfully integrated into a curriculum which is organized on a departmental basis. To circumvent the difficulties involved, many schools have created a special position for one of their regular staff, giving him the title of **health coordinator.** This individual may either have been a biology teacher, a physical education instructor, or someone possessing especial training in health education which would fit them for such a position. His task is essentially the continuance of the health program in the elementary grades with the object of **fitting health into** an already overcrowded high school curriculum.

One of the first tasks which the health coordinator is confronted with is that of fitting the health examination program into the high school curriculum. There are a number of possibilities open to him. He may continue in the manner set by the medical inspectors and con-

fine the program to bare essentials stripped of any relationship to healthful living or he may appeal to the **health council** for assistance in making it a truly educational experience. Some of the best enthusiasts in high school circles are to be found among teachers who themselves have experienced ill health due to factors which they have later come to discover were **wholly unnecessary** and could have been **prevented.** Such individuals are usually quite partial to the efforts of the school health staff and will lend their utmost support to the health examination program.

ANY EFFORT made to extend the usefulness of the health examination program at the high school level must take account of **what is ideal** and **what is most expedient.** In the writer's experience the practice of arranging definite appointments throughout the school year has yielded the most satisfactory results. This approach permits the student ample time in which to discuss his examination with his parents and, in general, prepare himself for the experience. Better still is the program which provides for a meeting with the student previous to his examination for the purpose of explaining the purpose and content of the health examination. Following the completion of the examination, the student should be given ample opportunity in which to discuss with the school physician the findings and program of correction. Satisfactory rapport between the student and the health worker will eventuate when the atmosphere surrounding the examination is business-like and friendly. It should be a pleasant experience for the student regardless of the findings of the physician.

Some students will want to go to their family physician for their annual health appraisal. They should be commended. As a matter of fact, this should be one of the main objectives of the school health examination; namely, the **interpretation and understanding of community health service** and particularly **the functions of the practicing physician.** It should answer the **how** and **why** of health service. How great a problem this is can be readily appreciated when it is realized that at the present time barely four percent of the American public avail themselves of preventive medical services. Make no mistake about it. We will never alter this unfortunate situation until every high school graduate is definitely convinced of the merits of preventive medicine and subjects himself willingly to a physician for a comprehensive periodic health appraisal.

Relation of School Health Service to Community Health Services

OF CONSIDERABLE significance in recent years have been the efforts made by some communities to acquaint practitioners of medicine with the aims and objectives of school health service. These communities have been rewarded by increased co-operation and tangible help which would not have been forthcoming otherwise. When it becomes generally appreciated by parents and practitioners of medicine alike that the school has a justifiable interest in the health of its charges then we are likely to see definite progress in community understanding. As long as the school adheres strictly to its primary function of education including health education in its broadest sense, there is small likelihood of its becoming involved in needless controversy. If clinics are established for the treatment of abnormal conditions found in school children, it seems only prudent that they be left outside the confines of the school.

Health Service as Education

IN THE WRITER'S estimation the educational resources latent within a well-organized school health service are literally unlimited. Unfortunately, in many cases, however, they remain hidden to the gaze of the average health worker who fails to comprehend the real purpose of school health service. But like the man who to his surprise found a treasure in his own back yard, the op-

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THE SCIENCE TEACHER

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A Journal of
The Illinois Association of Chemistry Teachers
The Illinois Biology Teachers' Association
The Indiana High School Chemistry Teachers' Association
And Serving Other Science Associations

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MEETING OF INDIANA CHEMISTRY TEACHERS

The Indiana High School Chemistry Teachers Asociation meets this year in Indianapolis, at the Shortridge High School, April 19-20, for their annual meeting. Field trips to local industries of Indianapolis and a special dinner are featured on Friday, while for Saturday an interesting program has been arranged. Here will be presented new ideas, and an opportunity is offered to trade better methods. (Note the program appearing in this issue.)

It is also to be remembered that one of the great values of association meetings such as this is the contacts established and friendships formed. Teachers very often gain ideas in heart-to-heart talks with their fellows that are of much value in their work, not to mention the stimulus to improve that is gained. Usually both parties to the discussion are helped.

All Indiana chemistry teachers will want to mark the two dates, April 19-20, and reserve them for the meeting at Indianapolis. Start planning now.

OUR ADVERTISERS

Whether all of us recognize it or not, journals are largely made possible through the support of commercial firms who advertise. Their service to a publication should be given recognition. Some of our readers no doubt have already noted the consistent use of space by a number of advertisers. Actually some have not missed using space in any issue during the past seven years.

We believe firms who regularly lend their support to association work merit much consideration when it comes to the purchase of materials they are in position to supply. We would call your attention to the many excellent firms which regularly use our journal for advertising. We would also appreciate it if you would mention this journal in answering advertisements.

Some Problems of the Junior Academy Movement

MISS E. M. J. LONG*

Normandy High School — St. Louis, Missouri

In view of the rapid growth of the science club movement, it is well that we give consideration to its development, objectives, and dangers to be avoided.

As a matter of gaining some perspective relative to the situation, let us note that science clubs began to increase noticeably during the early part of the twentieth century. Among factors contributing to the movement, no doubt one was a growing feeling among science teachers in the secondary school that too little work of a practical or functional nature was being accomplished in the time allotted to science subjects and that a period of greater freedom was needed to develop initiative and produce more satisfying results. Fortunately, educators saw the value of these extra-curricular activities, so that in some schools the administrators began allowing school time for the work.

There were problems, however, that had to be solved. Materials for work which many schools could not purchase were needed. Students also needed to interchange ideas with other boys and girls and to have fellowship with those whose interests were similar. Fortunately the American Institute of Science and Engineering Clubs and the Student Science Clubs of America tried to meet these needs by holding science fairs and science gatherings. As a result New York and Pennsylvania have become strong science centers.

The science club movement grew rapidly in other states. In Illinois it followed a somewhat different course guided by the Illinois Academy of Science. It was felt that students would profit by associating with the senior academy members and by competing with other children. The Iowa and Kansas Junior Academies operated in a somewhat similar manner. It was believed that the granting of prizes would arouse student interest and result in better work. This plan has been followed by many science club groups.

In Missouri, however, the Junior Academy of Science developed a pattern which differs somewhat from that of other science club groups. Students wrote and presented papers about their original investigations. This also was done by other junior academy groups. Students exhibited their work, and in special cases students presented their work before sections of the Missouri Academy of Science. The boy and girl who did the best work were recommended by the executive committee of the Missouri Academy of Science to the American Association for the Advancement of Science for honorary junior membership in that body.

Since some of the organizations now giving prizes doubt the wisdom of this procedure, it might be well to suggest a different and possibly better plan, such as placing available money in part help scholarships, supplying material for experimentation, or providing traveling expenses for junior academy members. In this way students could go to other states to give papers and exhibit their work, thus making interstate co-operation possible. Also summer vacation trips might be arranged, as many school districts have buses which can be used for this purpose at low cost.

Competition for profit, however, may result in undesirable outcomes as it has in athletics. Competition has commer-

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*Miss E. M. J. Long is chairman of Missouri Junior Academy of Science and was also vice president of the first American Youth Congress.

The Insect and Human Welfare

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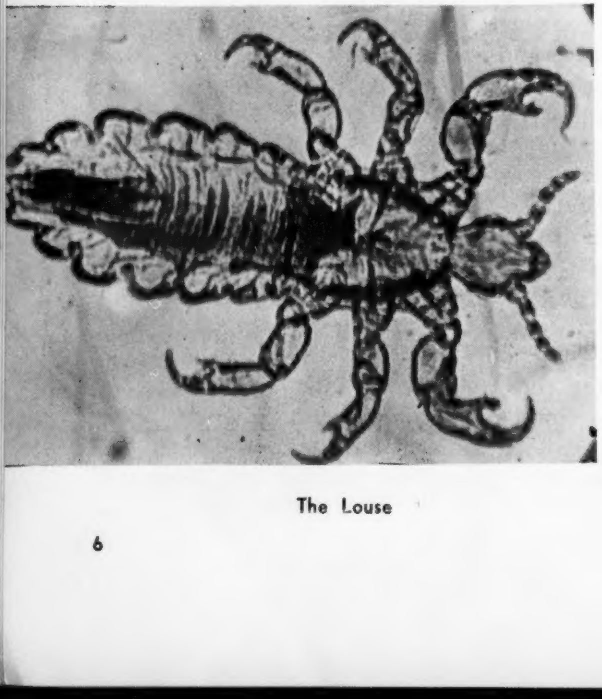
THIS IS THE third of a series of articles appearing in The Science Teacher encouraging acute emphasis upon the more practical phases of insect instruction somewhere along our public educational system. It is perfectly conceivable that some insect instruction be presented on a level justifiable under the caption "Nature Study" for the elementary grades. There is no doubt that a certain amount of the material should be presented to the junior high school grades, but definitely, the impelling motive back of this series of articles on insects is the need for using this subject matter in building a more practical and modern high school biology course.

The first of this series of articles by this author appeared in the October, 1939 issue of The Science Teacher under the title, "A Study of Insects Affecting the Home." The second article appearing in the December, 1939 issue was written by Dr. Townsend of the Department of Entomology, University of Kentucky, and dealt with "Some Common Chicken Lice."



The Louse

An article covering the entire multitude of evils and good that arise out of the conflict of insects with man is an almost impossible task. However, an attempt will be made to present the high lights of such a conflict. The insects affecting people will be classified in this paper as being either lice, fleas, ticks, flies, mosquitoes, bugs, or mites.

LICE

THE LICE of the human are of but three species, namely, the head louse, Pediculus capitus; the body louse, Pediculus corporis; and the pubic crab louse, Phthirius pubis. All three species are ectoparasites and feed only upon blood which is sucked from the human.

The head louse and the body louse are very similar in appearance, being flattened, grayish, wingless insects, usually less than 1-6 inch long. These two species are quite serious insect pests. They sometimes cause great irritation following the biting and generally provoke scratching in greatly increases the possibility of infection. Victims of both head and body lice as a rule feel tired and have increased temperature as a result of the feeding of the lice. The most serious effect of lice infestation in America is the development of typhus fever, a disease which ordinarily has proved from 15 to 20% fatal.

The public crab louse is a vastly different looking insect from the body louse. It is usually less than ½ inch in length and quite crab-like in appearance. It is normally found among the hairs of the pubic region, the stomach and the arm pits. Severe itching and irritation follow the feeding of the crab louse generally resulting in scratching, which in turn may be followed by a dermatitis or eczema.

SUGGESTED controls for the above-mentioned three species of lice are as follows:

(1) The head louse — Pediculus capitis.
   (a) Clipping and burning the hair will facilitate control.
   (b) Treat head with equal parts of kerosene and olive oil over night and follow with thorough shampoo in the morning.
   (c) Treat head with full strength grain alcohol.
   (d) Treat head with zylene, 95%, and vaseline, 5%, for one-half hour and follow with vigorous shampoo.

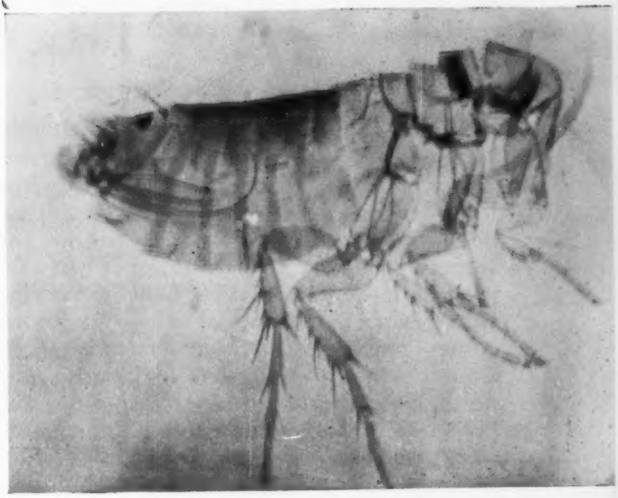
(2) The body louse — Pediculus humanis corporis.
   (a) Fumigation of all clothing by hydrocyanic acid gas or carbon bisulphide or carbon tetrachloride. (Note: Hydrocyanic acid gas is extremely poisonous).
   (b) Victim should take a bath in hot water and soap.
   (c) A mixture of kerosene and olive oil may be applied to the body, and should be followed by a hot bath after a half hour or more has elapsed.

(3) The pubis louse—Phthirius pubis.
   (a) Avoid frequenting unsanitary public toilets, public baths or unclean rooming houses.
   (b) Frequent and repeated spraying of the infested parts with full strength commercial grain alcohol.
   (c) Applying a commercial derris ointment.
   (d) The mercurial ointments formerly used are very poisonous and are no longer recommended.

FLEAS

THE FLEAS are for the most part small, brownish, hard-skinned insects which have their bodies distinctly compressed laterally and they usually possess quite prominent spines. Fleas, like lice, are ectoparasites and are blood sucking. They have the peculiar habit of biting two or three times in a row, their bites being followed by painful irritations. The most serious result of flea infestation is the transmission of bubonic plague from man to man. Bubonic plague is a bacterial disease that is 20 or more percent fatal. Fleas are also known to be the intermediate hosts of tapeworms which internally parasitize the human.

One of the more common fleas infesting people is Pulex irritans. When this flea is established in the home it



The Flea

can quite easily be controlled by a thorough cyanide or sulphur fumigation. Naphthalene sprinkled over the floors at the rate of one pound to 100 square feet of space in tightly-closed rooms for 24 to 48 hours is effective.

The Chigoe flea, Tunga penetrans, is a serious pest in southern United States and other tropical regions. It is a small reddish-brown flea which especially confines itself to burrowing into the skin between the toes and under the toe nails, often causing infection and blood poisoning. Entire toes, feet or legs have been lost as a result of this infestation. Chigoe flea sores should be opened with sterile instruments, the fleas removed and the wound given an antiseptic dressing.

TICKS

THE MOST serious of all the ticks affecting the human is the spotted fever tick, Dermacentor andersoni. It produces a tick paralysis which first affects the legs or arms and later completely paralyzes the entire body. In a certain area in Montana the bite by the spotted fever tick runs from 70 to 90 per cent fatal. The female is dark reddish-brown and the male is grayish-white. If these ticks are found attached to the skin, they should be touched with

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Science in Modern Living*

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WHAT IS THE function of science teaching in present-day America? How can the teachers of science best focus their expertness on the problems, needs, and interests of young people and society today? With changes in the school population and accompanying changes in educational theory, it becomes increasingly clear that the traditional science courses of study and methods of teaching are to a large degree irrelevant to the interests and needs of American society today. Science teachers must realistically face the question of how best to contribute to the development of individuals equipped for rich and full participation in the many aspects of modern living. What precisely must be their task?

In the first place, it must be very clear to the teacher of science that he **must** look away from the traditional organization of his subject matter if he is to gain clarity of vision concerning his function as a teacher. He must realize that the organization of his subject matter is an organization of expediency for the development of further knowledge within that field. And although he must recognize the need of such an organization for the ends of specialized research, and although he may be encouraged to engage in this research, he none the less must recognize that, as a teacher of young folk in a dynamic society, he must organize their learning experiences around problems that are real to them rather than around problems of academic interest designed to illustrate principles of a science. This emphatically does not mean that the principles of science are to be neglected. It means, rather, that they are to be selected for their significance in the lives of the learners; that they are to be employed as needed to aid in the solution of problems which are alive and still to be answered. It means that the fundamentals of science are to be used by the teacher as they are always used by the scientist—as tool informations and materials to be drawn from the archives in which they have been placed when and as needed to further a rigorous attack upon yet unsolved problems.

ONLY IN THIS fashion can young people be expected to develop understanding of the scientific method and its applicability to their own lives. Science is more than its archives, yet that which has often passed as science education has been a species of factual learning totally unrelated to the spirit and the method that is the essence of science. This spirit and method must obtain in the lives of our young people if they are to become competent, well-adjusted citizens in our society. Professor J. D. Bernal recently stated:

> The greatest defect of scientific education in the past has been its inability to transmit the most characteristic aspect of science, namely, its method. This was to a large extent inevitable, given the fact that few scientists or science teachers understood this method, . . . This practice (of the scientific method) is far more valuable than an accumulation of facts which, even if remembered, cannot be put to any use. . . . No exercise of logic can discover the scientific method. . . . The teacher can only bring out the processes of discovery by practicing it. The business of finding problems in situations, of formulating these problems, of solving them, and of checking the results, is something that can be appreciated by those who have carried it out. . . . Every science teacher and every science pupil must be to some extent a research worker.[1]

IN WHAT AREAS of living are these situations — these problems — to be found? For convenience, these areas are considered under three heads. But it must be cautioned that these areas are arbitrarily defined and that the chief element and value of the scientific method may be the developing ability to find these (new) relationships and problems in new situations.

First, modern man lives in a society

which is greatly influenced by the applications of science to communication, transportation, production, and consumption. The science teacher must aid young people in the development of increasingly operative understandings concerning the complexities of life and environment in this sensitively-balanced culture. He must help them to gain a vision of a more adequate culture based upon conscious and co-operative scientific planning. He must help them develop perspective on the present social and industrial scene through an analysis of the emergence of this industrial society, with which we are not yet at ease, from the individualistic and essentially agrarian society that we once knew.

SECOND, modern man must deal with a host of situations and problems arising out of the need to preserve and foster physical and mental health. Some of these problems deal with his personal growth and development, and some with the problems of health as they affect the whole society. The science teacher must develop understandings in the areas of growth and development from conception to senility and death. There are numerous problems, numerous (and needless) misunderstandings, and consequent emotional strains accompanying the life changes that human beings experience in growing up and in growing old. The science teacher should aid young people to achieve sane outlooks concerning every phase of this normal progression, offering materials and developing attitudes which will engender emotional assurance of progress toward adulthood, and self-assurance and competency in the various problems which young people experience in this area.

Third, science and the methods of science are more and more dominating our culture and so displacing faiths and beliefs of an earlier time. Science teachers must accept the responsibility of continuous orientation of young people to the best thought of this changing culture. The pragmatism of science is one of the major philosophies of all time. Yet, too often, it has been used as a dogmatic skepticism, which, upon knocking down and blowing away the straws of other dogmas, has left its unhappy believers with little in the way of values, and much in the way of disbelief in the possibility of existence of anything in the nature of values and standards. Yet science has been, to the men who developed it, a means which has contributed to making their lives meaningful and of worth. And it must become this to those young people who have experienced only its incisive thrust against those faiths which they see crumbling on all sides.

FINALLY, instruction in science must be dynamic and must constantly be adjusted to the abilities, interests, needs, and backgrounds of the young people with which it deals. It is not enough that we train the intellectually elite. Education today must serve **all** the young people if our democratic ideals of a functional, well-adjusted, and coherent society are to be advanced. The science teacher must realistically face young people as they are, conceiving the optimum possibilities inherent in each rather than attempting to force each student to conform to a predetermined mold of scientific excellence and arbitrarily set standard.

In order that teachers competent in the field of science may effectively serve young people, there must be a change in emphasis from academic problems to problems having community and personal reference. This view reflects an insistence that learning arises most surely out of activities which are felt to be vital to the learner, and that knowledge must always be considered critically in terms of the use to which is it to be put. It is through such teaching with this emphasis that science makes the contribution it can, and should, make to modern living.

1 J. D. Bernal, "Science Teaching in General Education," Science and Society, Vol. LV., No. 1 (Winter, 1940).

*This paper is the outgrowth of a panel discussion on "Science in Modern Living," conducted at the American Museum of Natural History, December 8, 1939, under the auspices of the General Science Association of New York City.

Vitalizing the Physics Course

HOWARD OETTING

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THE GOAL in any science course is to establish habits of scientific thinking and living. Teaching is of little value unless it clarifies and emphasizes the scientific principles involved. A practical course is one which gives a clear and thorough understanding of these principles. To achieve this kind of teaching, interest, which is a prerequisite for efficient learning, must be attained, and it must be focused on the idea of learning.

Much has been said about the plight of high school physics. Most of us acknowledge this plight but fail to do anything about it. I think the course is flexible enough to withstand any amount of stress without causing any damaging strain. I suggest we abandon the old method by which we were taught and teach physics as a club activity, always remembering that we are dealing with a dynamic youthful society and not with a static group. Since high school pupils are very active, let us give them activities. Of course, these activities must have direction, which depends entirely upon us as teachers. Educational research has found that children learn and develop best by doing, that they need first-hand experience with all phases of their environment, that their learning has a logic of its own which does not fall into the traditional school pattern. Activities in a physics classroom will make students interested in their learning and eager to extend their knowledge. Students should be allowed to do something with a purpose of their own and not always coerced into an unhappy situation by a classroom teacher, whose only excuse is that college entrance requirements force him to teach physics as a preparatory course. The sooner we as high school teachers cast off this traditional influence and teach physics for the majority instead of for the minority, the sooner we shall see physics increase in usefulness and justly earned popularity.

THE PHYSICS classroom and laboratory should be transformed into a **club room.** Such an environment is natural for the stimulation of interest. Teachers of the old school will scoff at such an arrangement comparing it to a play room. It is important that the students enjoy physics because those classes which are enjoyed will be the ones that accomplish most. Interest brings forth enjoyment. Interest is never created by coercion; instead it is "snuffed out" when a student is forced into a learning situation. An individual learns best, when there is a driving power from within — a driving power of interest. If a student is coerced into a learning situation, he feels no personal need for that learning. A pupil must see a need for that learning. A pupil must see a need before he will acquire the proper learning behaviorism.

At the front of this so-called "club room" there should be a complete scientific library with the latest books on science and a number of the best scientific magazines. The students should be encouraged to use these materials for help in solving their immediate problems and for leisure time reading as well. Such easily acquired material makes for both efficiency and interest.

The walls of the room should be covered with blackboards and bulletin boards. Both should be used continually to display the work of the students, along with charts, graphs, and scientific illustrations which may be secured from innuemerable sources. Over these boards there should be shelves displaying projects which the students have oon-

structed during class activities and during their leisure time.

THE ROOM must have a work shop to make it complete. This shop should have work benches, and all the necessary tools for students to construct any desired project. With this arrangement, students will make the physics club room their meeting place before and after school. They will come in during their free time to work and carry on their explorations. This method of teaching is not an easy one. It will take more time and work to keep this organization functioning, but it will be more interesting for the teacher and more enjoyable.

In our school, classes are sixty minutes long and meet every day of the week. This schedule is ideal because the teacher may have laboratory when and as often as he needs it. The first four meetings of the week are used for discussions, experiments, and demonstrations. The meeting on Friday is interest day. On this day students do anything in the laboratory they wish as long as it pertains to physics. You will find this one meeting a week to be insufficient for most students. To satisfy their interests they will come in during their free periods and after school.

AFTER COMPLETING projects, students are asked to write them up as experiments, listing all materials used, the procedure in construction, and the scientific principles involved. When a phase of physics pertaining to their particular projects is being discussed they are called upon for reports and are asked to illustrate with their projects. Boys and girls of high school age usually have a keen desire to show off their handicraft and discuss it with their group. At times it is possible for physics students to give their reports and demonstrations before the general science classes. The highest degree of interest is attained in a class when a student announces that he has completed his project and is ready to try it out. At once all work is stopped, and the student with his project is the center of interest. If it is successful, everyone will comment on the project, and the student will at once explain the scientific principles involved. If it fails, there are many suggestions offered by the entire group to correct the faults. High school students are very liberal with their praises and criticisms. Often projects are revised because of constructive criticisms offered by other members of the class.

Physics treated as an avocational subject often leads into worthwhile hobby activities. A juvenile court judge once said, "Give me a boy or a girl with a worthwhile hobby and I can assure you a worthwhile man or woman." J. Raymond Schutz said that he made a study of one hundred biographies of men who are America's outstanding leaders. As a result he discovered that eighty-three out of the hundred had a very definite hobby, and that sixty-three of these made their contribution to society not through vocational but through their avocational interests.

INTEREST activities in a physics laboratory should be purposeful, and most of them carried out in groups, thereby demanding co-operation among members of the groups. We, as physics teachers, realize that it is important to teach facts and principles in a science course, but we cannot let such facts and principles overshadow other crying needs which our schools have so utterly failed to teach. In any course character is the goal. Let us then by respecting the individual personalities of our students synchronize the teaching of science and the development of character.

Club activities in the science class room are infinite in number. It is impossible to list all of them, since most of them depend upon the interests of the students and the ingenuity of the teacher. Here are some of the activities which

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Science for Society

EDITED BY JOSEPH SINGERMAN

A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.

Science Education For Intelligent Citizenship*

C. C. FURNAS

Yale University — New Haven, Connecticut

Dr. C. C. Furnas, Associate Professor of Chemical Engineering at Yale University, is a recognized consultant in his field. He is equally famous among teachers of science and the public in general for his "America's Tomorrow," "The Next Hundred Years," "Man, Bread and Destiny," and other writings.

One would have to look far, indeed, among our scientists for an equal to Dr. Furnas in all-around success. Just as in college he excelled in athletics as well as in scholarship, so does he stand eminently among leading American scientists as one of the leaders in directing attention to the social implications of their work.

—Joseph Singerman.

IF ANYTHING resembling democracy is to survive, it appears to be self-evident that the voting public must be well-grounded in the knowledge of the way of life of the community. If we don't know the world in which we live we can hardly hope to do an acceptable job of running it.

As long as we lived in what was essentially an agricultural economy, centered largely around the individual homestead and the small village, it was relatively easy to grasp an understanding of the community life, its problems and their solutions. The school for adequate living was largely found in life itself. That was America, but it isn't America any more, nor Europe, nor Asia, for that matter. The octogenarian looks at us, thinks of his peaceful youth, shakes his head and mutters, "My, how you have changed."

Whether we have changed for better or for worse depends largely on how well we handle our problems during the years which lie before us. We are now predominantly an industrial nation. The operation of the bulk of our industry, and to a considerable extent our agriculture, is based upon the application of the mass of knowledge gleaned from experimental science. I submit for consideration the proposition that no national life based on applied science can operate satisfactorily if the bulk of the people are ignorant of science and its potentialities any more than a symphony orchestra can turn in an acceptable performance if the individual players are devoid of all knowledge of music. For this reason, I think modern education fails in its task unless the pupils leave the well-trampled hallways with a good grasp of the fundamentals of science and an understanding of its implications in the social scene.

I AM NOT suggesting that an attempt should be made to cram enough knowledge down everyone's throat to make them expert biologists, physicists, chemists or engineers. That would be fatal, even if it were possible; and science teaching in the past has been far too intent on producing specialists with no thought given to producing citizens. At the present time we have a far greater shortage of competent citizens than of scientific specialists.

It's easier to tell what the average citizen shouldn't be like than to outline any constructive ideal. Here are a couple of undesirable characters.

When I'm trying to make polite and harmless conversation with a historian I may mention that some of the new synthetic fibers appear to be headed toward making the silkworm obsolete and that this development may very well bring about some radical changes in that part of history which concerns Japan and the United States. The stock reply of an average historian to such an idea is: "That's chemistry. Phew, take it away!" That attitude doesn't offend

me, particularly, but it does make me feel sad about America.

THEN, THERE IS the assortment of high-minded, gushing females who make up the backbone of all properly oriented tea and cocktail parties. Their line: "Aren't the scientists wonderful—they're marvelous — they can just do **any**thing!" That makes me very ill.

As long as the average citizen, particularly the intelligent or influential one, looks on science as a boring impediment to living, or on the other extreme, thinks of scientists as magicians, we're not going to get anywhere. One of the essentials of good citizenship of the future will be a realization and an appreciation of the fact that science, pure and applied, is a vital part of our life, ranking with trees, mountains, butterflies, music, statesmanship, food and clothing. And such an appreciation of its importance will not come without some study and some training in the subject matter of science itself.

THESE generalities are rather feeble chatter and beating about the bush. I'll be a bit more specific. Any high school course in science worth its mimeographed outlines will bring a realization to the students that our entire existence is now based upon the use of the materials we find in the crust of the earth, in the ocean, in the atmosphere and on the shower of radiant energy coming down from the sun. The student will also grasp the idea (it's not so difficult really) that we are depleting our natural resources from the earth's crust at an astounding rate; that during the last century genus homo has robbed this storehouse of far more material than he has during all preceding earthly time; that serious depletions of some essential resources are uncomfortably imminent. He will also be brought to see that many constructive steps can be taken by scientists, by industrialists, by legislators, to forestall this depletion. The citizen who thinks that science is bunk or magic will vote for the potential congressman who hands out the biggest bags of potatoes. The citizen with some grasp of the significance of science will vote for the one whose talk makes sense.

EVERY ONE agrees that saving or prolonging human life is the noblest of all possible deeds. But the student who has learned anything really important about human biology sees some troublesome rocks ahead, brought on by our grasp of the significance of science will vote for the one whose talk makes sense. humane saving of the sick. He realizes that the whole field of hygiene and immunology, which sprang in large part from the work of Pasteur, is cutting down the death rate of children remarkably; that the children who once would have died now live to be old men and women. He learns that many of the medical specifics, such as salvarsan for syphilis, sulfanilimide for streptococcus infections, sulfapyridine for pneumonia are also lengthening the life of the middle-aged people. He learns that while in 1900 only one American in 16 was over 60 years of age, now one person in 10 is over 60; and in 1980 one person in five in America will be over 60 years of age or over. Forty years from now one fifth of the population will have come to the point where most of them will have to be cared for. It doesn't take a very bright student to grasp the idea that it might be a good thing to start now adjusting our social structure to take care of that. He might even be interested in doing something about it at the first opportunity. But if he knows nothing of the facts, nor of their implications, and if he doesn't have the proper respect for the interplay of cause and effect, he will brush aside any ideas of the desirability of doing something about it. He will shrug a bit and say: "We whipped the Britishers, didn't we? I guess we can take care of this if it comes along."

WIDESPREAD science education is certainly not going to bring on a millenium and it won't be a cure-all for social ills, but it certainly will be a necessary and major step toward that time when society operates intelligently. Intellect has never been given a real chance in the past and perhaps it isn't essential for human society to be intelligent. But a few wisps of mass intellect

(Continued on page 24)

Science Clubs at Work

EDITED BY KARL F. OERLEIN

State Teachers College California, Pennsylvania

A department devoted to the recognition of the splendid work being done by the science club members and their sponsors in the various State Junior Academies of Science. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Dr. Oerlein.

Plant Culture Without Soil

CHARLES M. COOK*

High School Student

Ambridge High School Ambridge, Pennsylvania

Hyroponics is the name of the branch of science that deals with the growing of plants in a culture solution. This can be accomplished by making a solution of the chemicals a plant needs for growth and supplying it to the roots of the plant. The two main types of solution cultures are water culture and sand culture. Water culture consists mainly of having a tank filled with nutrient solution in which the roots of the plants are suspended. The stem of the plant receives all the support while the roots hang free. Sand culture differs in three ways from water culture. Instead of the tank being filled with water, it is filled with sand. The nutrient solution is regularly poured over this. The plants grow in the sand as in ordinary ground and do not need any outside support. A sand culture does not necessarily have to contain sand. Sand, gravel, cinders, or anything that will properly support the roots of the plant may be used.

The solution in a sand or water culture should be kept as near neutral as possible. If it is too acid it is liable to dissolve iron until the amount of iron reaches toxic concentration. If it is too alkaline it is also dangerous to the plants, but this is not as dangerous as overacidity.

Hydroponics is not as difficult as its name sounds. We started out our experiment with no experience whatsoever. Ours was a water culture. Our water garden was put in a large tank that had formerly been used as an aquarium. Before it ws used it was washed thoroughly. Then a piece of wire netting of ½" mesh was taken, bent to form a basket, and used to support the excelsior we later covered it with. This method is not very practical unless the wire basket is reinforced. Otherwise the weight of the excelsior and of the plants may cause it to sag.

The formula used was developed by the United States Dept. of Agriculture. It is as follows: monobasic calcium phosphate, 1.91 oz., sodium nitrate, 1.56 oz., magnesium sulphate, 4.66 oz., and potassium chloride, 1.29 oz. To this should be added two grams of ferrous sulphate. These chemicals should be of the grade of commercial fertilizers. They are enough to make fifty gallons of solution. We mixed the solution in a larger tank and when we needed it we siphoned it into the tank that contained our plants.

Plants suitable for an experiment in hydroponics can be secured at any good greenhouse, but it is rather easy to grow them yourself. The seeds we used were radish, bean, and tomato. When we wanted them to germinate, we wrapped

(Continued on page 35)

*Charles Cook is 15 years of age and a member of the Science Forum of Ambridge High School. Mr. Joseph M. Benkert is the sponsor.

Preparation of Metallic Lithium

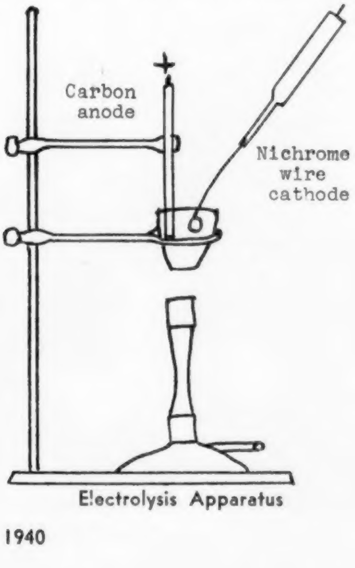
ARTHUR Z. GUTTERMAN

Senior, The Fieldston School

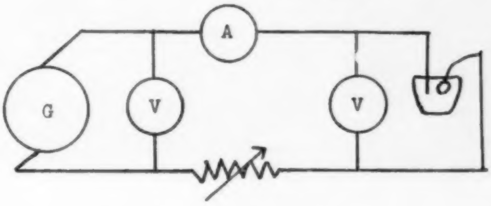
Fieldston, New York

THE PREPARATION of metallic lithium by electrolysis of fused lithium chloride is not a very common or well-known experiment. In the first place, lithium is not only rare, but also quite useless. To most people it is merely a scientific curiosity, and very few schools even stock lithium or its compounds. Another point is that, since lithium belongs in the same group as the alkali metals do, it is usually associated with sodium and potassium, which are very active metals and could never be obtained by the method of electrolysis. Also, lithium is rather expensive.

But in spite of the fact that lithium is in the same group as sodium and potassium, some of its properties are very different, and it is because of that reason that lithium is so suitable for this experiment. It has a high melting point, 186° C., as compared with the other alkali metals and is also far less active, for the distance between the nucleus and the outermost shell of electrons is very small. Another factor is that lithium chloride has a low melting point, 613° C., and can be quite easily fused by a Bunsen burner . And last, but not least, it is absolutely harmless, possessing no corrosive qualities whatsoever.



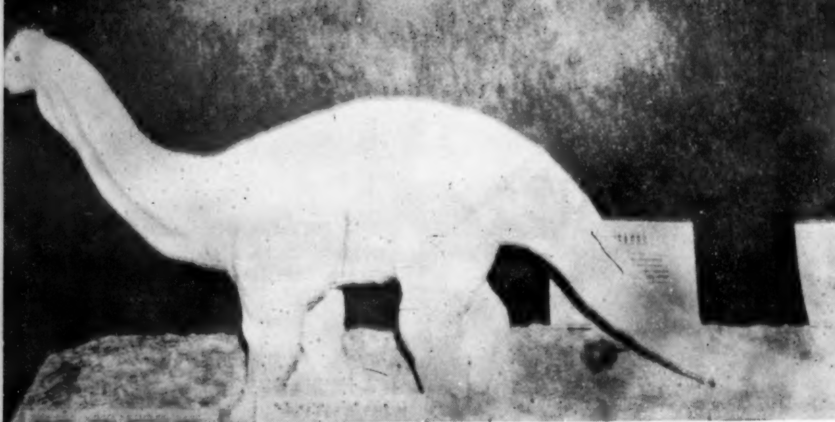
Electrolysis Apparatus



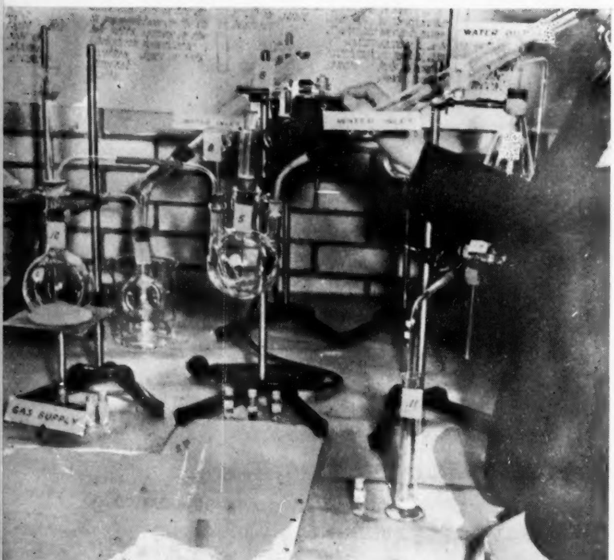
Wiring Diagram

AN IRON crucible is filled three-fourths full of lithium chloride and the salt fused over a Bunsen burner, or a Meker or Fisher burner, if available. More lithium may be added if necessary, so that the crucible will be about one half full of the molten salt. A carbon rod, which serves as the anode, is inserted in the crucible, without touching the sides or bottom. (As later experiments showed, a graphite rod works much better than a carbon one, and hence the more graphite the rod contains the more satisfactory it will be.) The cathode is simply a loop of No. 18 nichrome wire. This size will work best; but a lighter wire, or even a plain iron wire, may be used if necessary. The wire should be mounted in a suitable handle. Lithium collects in the loop and is held there by surface tension. When a current is passed through the fused salt, each chloride ion gives up an electron to the anode and thus becomes a chlorine atom. Each two atoms then combine to form a molecule of chlorine gas which is given off. The lithium atoms, on the other hand, receive electrons from the cathode and form metallic lithium which is deposited in the loop. When a small globule has formed, the wire is removed from the crucible and shaken over a beaker of kerosene to dislodge the lithium into the kerosene, where it quickly

(Continued on page 39)



JUNIOR ACADEMY EXHIBIT

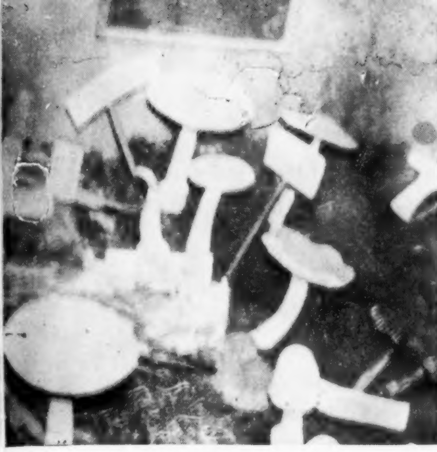


The pictures on this page tell a story better than it can be presented in words of the excellent work and fine exhibits produced by the science clubs working together through the State Junior Academies of Science. There is no better way of creating intense interest on the part of boys and girls than through participation in activities of this type.

Concerning the above pictures the following information is given from a letter of Dr. Anna A. Schneib, Eastern Kentucky State Teachers College, who is a leader in the Junior Academy of Science movement in her state.

The pictures shown above "represent only a part of the Kentucky Junior Academy of Science exhibit which was on display at the Columbus meeting of the American Science

Pictures to left and below are of exhibits of Junior Academy of Science of Illinois.



BIT

AT MEETING OF AMERICAN SCIENCE TEACHERS ASSOCIATION

Teachers Association and the American Association for the Advancement of Science. The exhibit was prepared by the Bellevue Science Clubs, Bellevue, Kentucky under the direction of the sponsors, Mr. W. R. Sebastian and Mr. W. H. Gribbell. The Bellevue Clubs were requested to prpare an exhibit which would represent the work of the Kentucky Junior Academy of Science because of the nearness of these clubs to Columbus.

"The dinosaur is the result of detailed research carried on by the club members concerning prehistoric animals and also concerning appropriate modeling material. This research was written up and received the Dr. Peter Award for the most original research carried out during 1938-1939.

"The birds shown were brought to school by some of the parents, and the club members saw the need of learning something about mounting birds. Mr. Sebastian's club now has a very large collection of mounted birds.

"Concerning the mushrooms, the club members had made a study of mushrooms and wished to reproduce them. An original formula was developed which was the result of much research. The natural colors are quite unusual. They are very true and many varieties are represented."

PICTURES WANTED

We are anxious to have pictures of student exhibits, whether at local or state meetings, or on the occasion of open house in the local community.

Diorama of the Laboratory of Louis Pasteur. Done by Paul Ash, Junior Academy of Science, Ball High School, Galveston, Texas. Miss Greta Oppe, Teacher.

Consumer Chemistry by the Problem Method

R. W. FOGLER

Illinois State Normal University — Normal, Illinois

IN TEACHING science in general education, one has to take into consideration whether he wishes to hand down a certain body of knowledge or facts to the student and hope they will be of some value to him, or choose content in terms of changes that he wishes to bring about in an individual and that will satisfy some of the basic needs of the individual. Science can contribute much to the development of critical thinking in an individual as well as give him a better world picture.

Problems used in a science class should not be purely scientific, but should be problems that have some social significance. In the third year science class at the University High School, chemistry is taught from the consumer angle. The consumer problem is an ever-growing one, and must not be neglected in our secondary schools. The procedure will vary from school to school, and the plan of approach described here is one of many that may be followed.

The first week or so is spent in general discussion of the products that enter the home and the bases of their selection. The approach is a positive rather than a negative one, bringing to the attention of the group that if a commodity has a use, it is because of some property of the material or materials of which it is made. Their properties are either chemical or physical in nature, and quality always depends upon the degree that certain properties exist in certain products.

THE PUPILS are allowed to browse around in the consumer science reading room with the purpose of selecting a problem for the group to solve. After a problem has been agreed upon by the group, each member of the group, working individually, starts reading on the problem and preparing his or her preliminary report. The preliminary report includes an introduction to the problem, the statement of the problem, the analysis of the problem, data sheets to tabulate the information desired, the tests needed to get the information that must be secured in the laboratory and, finally, a complete bibliography.

The progress of the pupil is ascertained each day from the report that is turned in at the end of each period. The report is studied and written suggestions are attached and returned at the beginning of the next period. The following day the accumulating report is again turned in and inspected, and suggestions made and teacher-pupil planning continues until the preliminary report is complete. The group then meets as a body, and the whole report is discussed and a composite analysis and data sheet is formulated. The testing program is discussed with the group. The teacher must examine the problem as soon as it is chosen and see all the implications and all the principles that can be taught in connection with it. Special emphasis must be placed on the scientific procedure, or the steps used in problem solving. The direction which a problem takes depends for the most part on the skill of the teacher to see the possibilities and open up the field to the student.

AFTER THE composite data sheets are completed, the students go into the laboratory and gather the data that is needed in the solution of their problem. Each student takes a different brand of the product to be tested, and the results are recorded on a common data sheet that is placed on the board or on a chart. After the testing period is over, the group meets again, interprets data and arrives at generalizations from data col-

lected. From generalizations the next step in the procedure is to draw the conclusions. The problem does not end at this point, however, as one must vision the problems that arise in putting these conclusions to work and making them function in the community in which we are living. The final write-up includes: introduction, statement of the problem, analysis of the problem, tests, completed data sheet, generalizations, conclusion, and bibliography.

As the semester progresses, the group is divided into smaller units and instead of one problem, the group will pick four or five problems, and each member will affiliate himself with the problem in which he is most interested. The procedure of each small group is the same as outlined in the problem chosen by the group. As they grow in the ability of self-direction, individual members are allowed to work on a problem of their own choice, and solve the problem individually. During the solution of the problem, a great deal of time is available to do some very effective elbow teaching. Principles and the language of science are taught as the student as the student needs it to solve his own problem. Much of the teaching is of an individual nature, and the testing program is of a similar nature. The testing is usually divided into three phases: chemistry of their own particular problem, test on the ability of students to recognize and carry out the different steps involved in solving the problem, and finally a test dealing with the consumer movement as it relates to the average individual.

THE STUDENTS, as they work in groups of four or five individuals with four or five groups in each section, are limited to either the fields of foods, drugs, detergents, cosmetics, or textiles. However, as the year proceeds, individual students may be working in any of the fields mentioned or any other in which they are interested. Some of the objectives which are striven for in the course are:

> To develop ability in problem solving, and make it function in all of life's problems; to develop ability and inclination in self-direction; to promote more intelligent buymanship; to develop consumer consciencene-ness in every individual; to show how chemistry polices the Food and Drug laboratories; to develop a knowledge of the technical language, formulas, and laboratory techniques of chemistry in relation to their own interest problems; to develop an appreciation of the service of chemistry to society through its contributions to health, agriculture, home, and industry; a general understanding of the chemical nature of substances and of general change in the transition of substances from one form to another; to develop a command of a reasonable amount of factual material.

A few of the problems that are studied during the year are: What are the properties of a good gelatin? What is the best motor oil to use? What anti-freezes are best for use in the radiator of an automobile? What are the quality guides for buying a toilet soap? What should the consumer know about the ice cream he buys?

Student Preliminary Report

ALL KINDS of liquids and solutions have been sold and used as anti-freeze preparations for automobile radiators, since motorists have quit putting automobiles on jacks during the winter months. They range from salt solutions to honey and from wood alcohol to kerosene. All of them, marvelous to relate, work! That is, they all work if they are expected only to keep the radiator from freezing.

The modern automobile is, however, a delicate mechanism and demands many other characteristics of the radiator fluid than low freezing point. Some of these desirable characteristics are noncorrosiveness to metals so that the radiator or engine parts will not rust, low viscosity so that the fluid will flow through the cooling system readily, ability to absorb heat, and absence of effect on rubber, gaskets, and automobile finishes. Low evaporation at operating temperature is also desirable.

ALL RADIATOR liquids should contain rust-retarding substances. They are present in practically all commercial anti-freeze preparations. Evaporation retarders — oily liquids added to the alcohol — will reduce evaporation slightly and should not add appreciably to cost.

Problem: What anti-freezes are best for use in the radiator of an automobile?

Analysis of Problem:

I. What are anti-freezes chemically?

II. What properties should a good anti-freeze possess?

A. Price.
1. What is the price per gallon of anti-freezes on the market?
2. Why is there such a range in price?
3. Is the price in reach of the ordinary car owner?

B. Boiling Point.
1. What is the average operating temperature of a car?
2. What would be a desirable boiling point?
3. What is the boiling point of the common anti-freezes on the market?

C. Non-Corrosive.
1. Do anti-freezes have a corrosive action on the radiator or engine?
2. Is water or the anti-freeze more corrosive?
3. Why are corrosion inhibitors added?
4. What substances are used as inhibitors of corrosion?
5. How could one identify such inhibitors in an anti-freeze solution?
6. Do anti-freezes show acid properties after continual use?

D. Specific Heat.
1. Does water absorb heat readily?
2. Which anti-freezes will absorb the most heat per gram?

E. Safety.
1. Is the anti-freeze safe to breathe in case the fumes escape?
2. Does the anti-freeze attack the finish of the car?

F. Viscosity.
4. Will the anti-freeze flow through a cooling system readily?
2. How does the viscosity of the various anti-freezes compare with water?

G. Evaporation Retarders.
1. What substances are used as evaporation retarders?
2. How do they affect evaporation?
3. Are they of any value in an anti-freeze?
4. How could one detect their presence?

H. Permeability.
1. Does the anti-freeze seep through connections, gaskets and rubber tubing?
2. Which anti-freeze permeates the cooling system least?

III. How much anti-freeze should be added to protect for winter driving?

A. How does one calculate the per cent of anti-freezes needed to protect for various winter temperatures?
B. Will the same per cent of solution of all anti-freezes protect to the same degree of temperature?
C. Which requires the least amount for a given temperature?

IV. How does one test the freezing point of the radiator solution by means of the hydrometer?

Data Sheet
For Comparing Various Anti-Freezes.

Brand				
Distributor				
Type of Alcohol				
Price per Gallon				
Boiling Point				
Specific Gravity				
Avg. oper. temperature of the car				
Temp. at which thermostat is set				
Evaporation Retarders				
Corrosion Inhibitors				
Seepage Tendencies				
Effect on car finish				
Specific Heat				
pH Value				
Viscosity				

Chart for Computing
Per Cent of Anti-freeze Temp.____

Steps in Calculation	Methanol	Ethanol	Glycol	Glycerol
Chemical Formula				
Molecular weight				
Weight of 1 cc.				
Vol. in cc. per molecular weight				
Spec. low. of a mol. wt. in 1 liter H_2O	3.35 F.	3.35 F.	3.35 F.	3.35 F.
Desired Protection Temp. ° F.				
No. of Molecular weights required				
No. of cc. required				
Vol. of water used	1000cc	1000cc	1000cc	1000cc
Total Vol. of Anti-Freeze and Water				
% of Anti-Freeze				

(Continued on page 28)

National Committee on Science Education

Progress in Developing a Functional Science Program

Next committee meeting, June 28-29, 1940, Pfister Hotel, Milwaukee, Wisconsin. Meetings of Department of Science Instruction of National Educational Association are scheduled for July 1, 2, and 3 at the same hotel.

The following information is presented as gleaned from the committee report and from letters from subcommittee chairmen.—Editor.

A FUNCTIONAL science program for all schools is an objective likely to be attained if we may judge from the work of the National committee on Science Education during the past year. The program extends from the early elementary grades through the high school and junior college. We note that the basis for planning a science course, particularly in the high school, is not the traditional one of science for the sake of science with its very marvelous logical organization. Instead, science education is planned according to the needs of the individual as a part of a democracy.

Some indication of how the work is going may be seen in the work of the philosophy committee, which is actually laying the foundation for the work of the other subcommittees. This committee, much to its credit, has unequivocally broken with tradition and set up a forward-looking view of the philosophy of science education that will promote progress. Its preliminary report is indicated in brief in the following outline of which sections two and three are to be especially noted.

1. Introduction.
   - A. Science in modern living.
     1. Foods and nutrition.
     2. Plastics.
     3. Insulation and air conditioning.
     4. Communication.
     5. Transportation.
     6. Radio and movie.
     7. Personal health and length of life.
     8. Public health and sanitation.
     9. Conservation.
     10. Application of scientific method to social problems.
   - B. Goals of education in a democracy.
     1. Education must contribute to democratic living.
     2. The Policies Commission has shown haw education contributes to democratic living.
2. Desirable functional outcomes of science education.
   - A. Health.
   - B. Safety.
   - C. Recreation.
   - D. Maturing philosophy of life.
   - E. Intelligent consumership.
   - F. Orientation to work.
   - G. Conservation.
   - H. Maturing interpersonal relations.
   - I. Responsible socio-economic action.
3. Broad aspects of science teaching which permeate all of the functional outcomes.
   - A. Critical thinking.
   - B. Loyalty to democracy.

The implications of the philosophy of science education as here outlined, indicate that the functional outcomes of section II above may be adjusted to meet the needs in all areas of school activities from the preschool and kindergarten through the grades, high school and junior college.

WORKING very closely with the Philosophy Committee is the Needs Committee headed by Dr. W. C. Croxton, State Teachers College, St. Cloud, Minnesota. The committee is making a direct application of the philosophy and is working out functional outcomes of science education at various grade levels. In doing this work they have had the help of teachers in many schools throughout the country. The co-operating teachers have attempted to formulate desirable functional outcomes based on study of personal and social needs. The compiled work of the group has been tentatively placed according to grade level and to the goal to be achieved, whether recreation, health,

safety, intelligent consumption, orientation to work, conservation, maturing philosophy of life, maturing interpersonal relations or responsible socioeconomic action. It now requires validation as to grade level and goal by trained teachers and teacher groups. If you can help, write to Dr. Croxton or to the committee secretary, Mr. Jach Hudgpeth, State Teachers College, Austin, Texas.

In attaining the functional outcomes that are being set up, teachers must have materials. Finding these materials or having them provided is the work of the Materials Committee, headed by E. S. Obourn. The special fields being explored are reading materials; visual aids; science institutions, societies and museums; radio, television, and recording; science clubs, fairs, and assembly programs; textbooks, laboratory manuals and workbooks.

IT IS INTERESTING to note the kinds of materials recommended by the committee as desirable to use or that should be developed. Especially was it emphasized that much local material was not being used as it should and that it should be brought into the classroom or made use of through field trips. The fields marked for thorough study are here listed and also the chairmen of the committees so that those who can help may write to them.

A. Reading Materials — Chairman, Margaret S. Burke, 1512 Schley Avenue, San Antonio, Texas.

B. Visual Aids—Chairmen, Leroy E. Smith, South High School, 24th and Jay Streets, Omaha, Nebraska; and W. W. Strait, Culver Military Academy, Culver, Indiana.

C. Science Institutions and Societies and Museums. Chairman, Mrs. Leta Gregory Thomas, Lecturer, Field Museum, Chicago, Illinois.

D. Radio, Television and Recording. Chairman, Emil L. Massey, Supervisor of Science, Detroit Board of Education, Detroit, Michigan, and L. E. Jennings, Cass Technical High School, Detroit, Michigan.

E. Science Clubs, Fairs and Assembly Programs. Chairman, Mervin E. Oakes, Queens College, Flushing, New York.

E. Science Clubs, Fairs and Assembly Programs, Chairman, Mervin E. Oakes, Queens College, Flushing, New York.

F. Textbooks, Laboratory Manuals, and Workbooks. Chairman, John C. Mayfield, University of Chicago, High School, Chicago, Illinois.

TO FACILITATE the adoption of better methods and practices among teachers a new subcommittee has been set up and known as the New Procedure Committee. Its work is to get successful and workable classroom practices to illustrate methods of attaining all the desirable functional outcomes listed by the philosophy committee and methods of handling other activities required by other subcommittees. Any one who knows of a teacher who is attaining some of these outcomes, or who himself has set up some good practice, should write to the chairman of the committee, Robert L. Ebel of the Edison Institute at Dearborn, Michigan. Your co-operation is especially needed in this particular work, as it cannot be done in any other way.

The work of the Evaluating Committee is well expressed in the following note from its chairman, Dr. Carleton E. Preston, University of North Carolina, Chapel Hill, North Carolina.

"The subcommittee on evaluation has the general problem first, of clearly defining, and second, of seeking to evaluate outcomes of teaching at several different levels. These outcomes are thought of in terms of (1) readiness to use the problem-solving approach, (2) the habit of safeguarding thinking through exercise of those attitudes characteristic of the scientist in his work, (3) the degree to which such attitudes

(Continued on page 37)

A New Game - Molecule

SHERMAN SPARKS

Mt. Olive Community High School — Mt. Olive, Illinois

Students may now have fun and learn chemistry at the same time, all because a new card game, Molecule, has been devised to help drill the important ideas of ions and atoms and the method of formula writing into the minds of even the slowest students. It uses chemical atoms, or ions, as units, and the object of the game is constructing and naming molecules formed by the combination of two or more of these units. The possibilities of the game may be seen from a brief description of it.

The cards are of regular bridge size. At either end of the card is printed the symbol or an element or radical and near the center is printed the valence and atomic weight for the element or radical indicated.

The game is played by dealing seven cards to each player and one face up on the table. The remaining cards are the reserve and are placed on the table face down beside the one card that is face up. The player at the left starts the game either by taking the card exposed or the top card from the reserve. After putting down cards for correct formulas (and naming the molecule) this player discards one card, laying it face up next to the reserve pile. The next player may take up one or more cards from the face up stack providing he can use the lowest card he picks up, or a card from the reserve, plays and discards.

The player who first uses all his cards, in making molecules. and discards one, closes the hand. Each card left in the

hands of the other players counts against them according to the sum of the atomic weights of the cards they hold subtracted from their score, which is the sum of the molecular weights they have laid down and declared. Four such hands constitute a game.

If a player lays down the wrong combination or misnames a molecule, he is penalized two times the molecular weight.

The person with the highest score (sum total of all molecular weights for the four hands less penalties) wins the game.

All chemistry instructors have students that experience difficulty in constructing and naming molecules. When writing equations it is essential that the student have this ability.

Some of these slower students have little difficulty in learning the fundamentals of games they enjoy. Molecule is a game that is easy to learn, whereas the fundamentals of constructing and naming molecules seem difficult as we teach them in the classroom.

SCIENCE FOR SOCIETY

(Continued from page 13)

here and there will certainly save millions of cracked heads and centuries of lost time. As long as mine is one of the heads which is a candidate for the cracking I shall be interested in seeing intellect have a chance. I don't know of any more logical place to start in giving intelligence an opportunity to function than in getting some idea of science and its implications across to the public. Perhaps it won't do any good, but it's worth trying — there's nothing else to offer.

*Summary of a talk presented by C. C. Furnas at a symposium on Science and Education conducted by the American Association of Scientific Workers at New York on February 9, 1940.

ANNUAL MEETING

Indiana High School Chemistry Teachers Association

Friday and Saturday, April 19-20, 1940

Shortridge High School, Indianapolis

Friday —

9:00-1:00 Registration.
1:00-5:00 Trips to local industries.
6:00-7:00 Dinner, Teachers Cafeteria, Shortridge.
Welcome by Mr. George Buck, Principal.

Saturday —

9:00-12:00 Meeting, chemistry lecture room, Shortridge.
Chairman, Allan R. Stacy, President of Association.
Secretary, Leda Mae Hughes.

"The Drunkometer," Dr. R. N. Harger, State Toxicologist.
"Color Photography," M. J. Arvin, P. R. Mallory Company.
"Fluorescence," Walter C. Geisler, Shortridge High School.
"Crystal Structure," Max Marsh, Shortridge High School student.
"Kinks and Quirks," an informal discussion of specific methods.

JUNIOR ACADEMY PROBLEMS

(Continued from page 5)

cialized sports, and boys often engage in athletics for monetary gain. There is real danger that the same motives may be carried over into junior academy work. It is questionable whether boys and girls should ever be allowed to work for set scholarships, trips or awards. Awards, when given, should be so casually and intermittently granted that they do go for honest labor well done.

Another danger to be considered is that of publicity. In cases arising of this type, the teacher does most of the work and puts on a show for publicity reasons. Such acts are contrary to the spirit of discovery and search for truth which has characterized the work and spirit of true scientists for centuries. This is no time to revert to the age of the charlatan and alchemist.

The science club should provide much freedom of action to its members. It should encourage students to make and remake discoveries. For teachers to do the talking and demonstrating and to set up an atmosphere of a formal meeting is to violate the principle of academic freedom of thought. The workshop atmosphere is much to be preferred. With the many and varied club programs now in effect and the rapid growth of science clubs and science club organizations, it is refreshing to see the American Institute of Science Clubs embarking on a course of action to bring about unity and higher standard of achievement. The American Institute is deserving of the full co-operation of every science teacher.

We must remember that in science clubs that are properly organized, the students learn the value of controlled experimentation; they enter into the spirit of discovery; they develop poise, public speaking ability, and a gracious manner; they are given leadership training and experience in organization work; they learn how to tap the resources of home and community; they

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VITALIZING PHYSICS

(Continued from page 11)

I have used and found very satisfactory in creating and maintaining interest.

A VERY interesting activity for boys and some girls is model-airplane construction. I organized an airplane club using my physics students as a nucleus for it. After the club became active it solicited other members of the school for membership. This arrangement naturally diffused interest throughout the whole school and non-physics students learned of various activities in the physics class by their association with my students. Last year during and after school hours our club constructed better than two hundred and fifty planes representing flying, scaled, and solid models. Three of these planes were gasoline powered. At the close of school we held an airplane meet, offering prizes for the best-constructed planes and for the best flyers. Some prizes were furnished by the school, and some were donated by the local merchants. I might add that there was so much interest the merchants offered these prizes without solicitation. Before the meet we displayed our models at the local theatre and in a show window of one of the merchants.

THIS YEAR it is our plan to have an interscholastic airplane meet with schools in our conference. Such a meet will hold the interest of any student participating as much as will an athletic meet. This year, also, we have another hobby in connection with our physics class, photography. Our organization of this activity is the same as is that of the airplane club. We have a modern photography laboratory which we intend to use every hour of the day as well as after school. Responsible physics students will have charge of the laboratory during their free periods to care for equipment and to supervise the photigraphic processes. The project of the club is to take pictures of all school activities and devise a pictorial history of the school year to be placed in the school library. Different members will be assigned to cover the various activities and they will be made responsible for the developing and printing of the pictures taken. Eastman Kodak company offers free prepared lectures with lantern slides on the different phases of photography. These lectures will be presented to the class by one or two of its members during the day and in the evening will be repeated by the same students to interested adults of the community. There will be three types of membership to the club-novice, apprentice, and amateur. All members will start as novices and will have to pass certain tests and cover certain assignments satisfactorily before advancing to a higher class.

Electrical work for all school plays, dances, and assemblies is done by two or more physics students who volunteer for these assignments and receive grades for work done upon recommendation of the teacher in charge. Students also bring broken electrical appliances from home, which they repair on interest day.

EVERY STUDENT is required to construct a physics dictionary. From the beginning of the course each student is required to hand in at regular intervals scientific words and their meanings on separate slips of paper. These words are inspected and returned to the students. Near the end of the course the students alphabetize these slips and construct an illustrative scientific dictionary. They collect pictures from magazines, papers, and catalogs to illustrate each word. If their interest is such, they are permitted to go to the arts and crafts room to bind their dictionary. The object of this project is to increase their scientific vocabularies and to make them science conscious when looking through different mediums of communication.

During our annual open house last year I allowed my students to prepare

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CONSUMER CHEMISTRY

(Continued from page 20)

Chart for Computing Number of Molecular Wt. and % of Anti-Freeze at Various ° F.

Temperature	Mol. Wts.	Methanol-	Ethanol-	Glycol	Glycerine
32° F					
24° F					
16° F					
8° F					
0° F					
-4° F					
-8° F					
-12° F					
-16° F					
-20° F					
-24° F					
-28° F					

Procedure

To determine the specific gravity of anti-freeze solution when the per cent of anti-freeze is known:

1. Take the percentage of anti-freeze and multiply by specific gravity.
2. Take the percentage of water and multiply by specific gravity of water.
3. Add the two products and the sum represents the specific gravity of the solution.

TEST ON ANTI-FREEZES

Ethyl Alcohol. (a) Warm gently together in a test tube about 1 c.. of anti-freeze, 1 cc. of glacial acetic acid and 2 cc. of concentrated H_2SO_4. Note the odor. A fruit ester is formed.

(b) Add 5 drops of the anti-freeze and about 3 cc. of a dilute solution (10 per cent) of sodium hydroxide to 5 cc. of water in a test tube. Add to the mixture, drop by drop, a solution of iodine in potassium iodide until a faint yellow color persists after the solution is shaken. Heat the test tube until it feels warm to the hand. If a precipitate does not separate at once, set the tube aside for a few minutes. Note the odor (iodoform) and color of the precipitate.

Methyl Alcohol (Methanol). Dissolve 5 drops of the anti-freeze in 3 cc. of water. Wind a piece of stout copper wire around a lead pencil so that a closely coiled spiral about 2 cm. in length is formed. Leave about 20 cm. of the wire to serve as a handle. Heat the spiral in the upper part of a bunsen flame, and plunge it while red hot into the solution of the anti-freeze. Withdraw the spiral, cool the liquid under running water, and heat again with the hot spiral. In this way, the methyl alcohol is oxidized by the hot copper oxide formed on the wire. Note the odor of liquid while hot. Cool the liquid, add 2 drops of a 0.5 per cent solution of resorcinol and pour the resulting mixture slowly so the two do not mix, down the side of an inclined test tube containing about 5 cc. of concentrated sulfuric acid. A pinkish red ring is formed at the junction of the two rings.

Isopropyl Alcohol. To 1 cc. of the anti-freeze in a test tube, add 4 cc. of distilled water and 10 cc. of mercuric sulphate test solution. Heat on a boiling water bath for three minutes. A yellow precipitate forming within that time indicates isopropyl alcohol.

Glycerine (Glycerol). Cover the bottom of a test tube with powdered acid potassium sulphate and then add 5 drops of anti-freeze. Heat strongly and note the odor. A disagreeable odor of acrolein is given off if glycerine is present.

Glycol. Cover the bottom of a test tube with powdered acid potassium sulphate and add about 3 cc. of anti-freeze and heat for a few minutes. If glycol is present, acetaldehyde will be formed. Its presence may be detected by adding a few drops of Schiff's* reagent.

*Dissolve about 0.2 gram of rosaline in a small amount of boiling water. Cool and add 15 cc. of a saturated solution of sulfur dioxide in water, and allow the mixture to stand several hours until it becomes colorless or pale yellow; then dilute to 200 cc. with water. The reagent should be kept in a well-stoppered bottle of dark glass.

Anti-rust Inhibitors. Several differerent compounds are used as anti-rust inhibitors, among them analine, tartrates, mercaptans, triethanolamine, morpholine, soap, kerosene and sodium nitrite. Most of these compounds are organic in nature and probably too far advanced technique is involved in de-

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The Apothesis of Science

(Continued from page 28)

tecting their presence. However, the test for analine, tartrates and nitrites, sodium bicarbonate and sodium borate, may be determined easily.

Analine. Warm about 2 cc. of the anti-freeze in a test tube with alcoholic potassium hydroxide and chloroform. Phenol isocyanide will be formed and it has a very evil odor.

Tartrates. Dilute 1 cc. of the anti-freeze to 10 cc. and add 1 drop of a 10 per cent solution of ferric chloride. The depth of color can be more readily observed by looking down the tubes placed on white paper.

Carbonates. Test for carbonates as directed in "Tests on Soaps."

Borates. See "Tests on Soaps."

..**Nitrites.** Place about 1 cc. of anti-freeze in test tube and 9 cc. of water. In another test tube dissolve 1 gram of urea in 5 cc. of dil HCl and heat to boiling. Pour this solution down the side of the other tube containing the solution to be tested. The tubes should not be shaken. Formation of bubbles indicates the presence of nitrite.

Sodium. Test for sodium as indicated under baking powder.

Boiling Point. Put 100 cc. of the anti-freeze in a distilling flask and fit to a condenser. Place a thermometer in a one-hole stopper and insert in neck of the flask. Heat and observe the temperature at which the liquid distills. Is the distilling temperature the same as listed in the handbook? Is there any evidence of an evaporation retarder?

Specific Gravity. Insert a hydrometer in a graduate or quart bottle containing anti-freeze and read the specific gravity from the scale on the hydrometer. If a hydrometer is not available, borrow one from the filling station. Check your reading with the one found in the chemistry and physics handbook.

Viscosity. Use the same equipment and method for determining the viscosity of anti-freezes as described under oil.

Seepage. To check seepage, allow some of the anti-freeze to remain corked in a radiator connection of an automobile for several days. Shake occasionally so as to have conditions somewhat similar to operating conditions. Examine the outside of the rubber connection to see if any of the anti-freeze has seeped through.

Car Finish. Obtain a piece of fender or hood from an auto wrecking business and immerse a small strip in the anti-freeze solution. After a few days examine the strip to see if it has attacked the finish.

Specific Heat. The specific heat of

THE APOTHESIS OF SCIENCE

The picture shown to the left represents a mural painting done by Elmer E. Taflinger, an artist of Indianapolis, Indiana. Robert Lovell Black, biology instructor of Emmerick Manual Training High School, Indianapolis, assisted in planning it. The painting shows eminent scientists of the Greek, Medieval, Renaissance, and Modern period. Each scientist is portrayed in such a way as to indicate his work and influence in the scientific field. The painting is about 5½ feet high and 21 feet long. It was on display at the meeting of the American Science Teachers Association at Columbus, Ohio, where it was presented and explained by Mr. Black.

the various alcohols used in anti-freezes may be found in the Chemistry and Physics Handbook. Remember the function of the solution in the radiator is to absorb heat.

pH Value. Test the anti-freeze solution with litmus to see if it is acid or alkaline. If it affects litmus, the pH value may be determined by using hydrogen ion color standard charts if they are available.

VITALIZING PHYSICS

(Continued from page 26)

mystery experiments and demonstrate them to the visitors. Among the activities in the school that night the physics laboratory was one of the most popular. At no time during the evening did I have to participate. My students were interested, and did an excellent job.

Some of the other projects carried out successfully by my students on interest day are as follows: pin-hole cameras, weather instruments, spectroscopes, radio receiving set, rectifiers, different-type batteries, electroplating, compasses, submarines, turbines, electric generators, telegraphs, ship models, sextants, electric furnaces, thermostats, planetariums, thermometers, telescopes, Pascal's tube and cask experiment.

ON THE bulletin board there is a suggestive list of eighty some projects from which students may choose. They are not held to this list, but may build or perform any project or experiment which they desire.

Physics at our school is an elective and it is forced to compete with other attractive subjects. It is by nature a hard course, and this fact alone will keep many students out of the physics classroom. It is the responsibility of physics teachers to overcome this obstacle by offering a course which will appeal to students. Physics is one of the most practical courses in high school and every student should take it by his own choice. My whole aim is to teach physics so that it will become the most popular course and the most interesting in the curriculum, not because I am a physics teacher, but because I think that every student needs it in order to live more efficiently in our scientific civilization.

In closing I should like to leave one thought with you and that is no one has ever made a definite success of anything unless he himself had a vital interest in it.

INSECT AND HUMAN WELFARE

(Continued from page 7)

a few drops of chloroform, gasoline or turpentine. Vaccines that establish immunity for a single season are now available.

The wood tick, Dermacentor variabilis, also affects the human. Since 1931 it is thought to be a carrier of Rocky Mountain spotted fever in the Central and Eastern States. A tincture of iodine should be forced into the minute hole made by the tick's mouth parts.

FLIES

There are so many flies of true Dipterous nature that are definitely injurious to man that only a few of them may be considered in this paper. The common house fly, Musca domestica, is among the most serious offenders. The transmission of twenty or more human diseases, some of which are most serious, is attributed to the house fly. Some of these more serious diseases include: typhoid fever, diarrhea, tuberculosis, erysipelas, gonorrhea, leprosy and gangrene. Because of the extreme common nature of this fly, no attempt will be made here to describe it or to suggest control measures.

THE tsetse fly, Glossina morsitans, a large brownish-black fly restricted to the continent of Africa has been found directly responsible for the transmission of African sleeping sickness. This is one of the blood-sucking flies and it is interesting to note that the tsetse fly and the common house fly of the North American continent both belong to the family Muscidae.

The tropical African sleeping sickness must not be confused with the sleeping sickness as found up here in the north temperate zone. The sleeping sickness of the North temperature zone is commonly referred to as encephalitis. According to medical statistics, there is an encephalitis epidemic area in the vicinity of St. Louis, Missouri.

It is now rather commonly thought by entomologists and other scientists that the transmission of equine encephalomyelitis, the sleeping sickness of horses and mules, is attributable to blood-sucking flies, probably of the family Muscidae. This disease caused the death of some 33,000 horses and mules in 1937. There is the feeling among some entomologists today that either mosquitoes or flies may be the transmitter of the disease from horses and mules to man.

MOSQUITOES

THERE IS perhaps no insect in the entire world which is considered so lightly and yet which is so completely a serious pest. Here in the North temperate zone, we seem to have but two genera of mosquitoes, namely the Culex mosquito, the most common one, and the Anopheles mosquito. Certain species of the latter transmit malaria. In the seaport cities of our Southern and Southeastern States as well as in tropical countries, a third genus of mosquito is found, the Aedes mosquito. In addition to inflicting painful wounds, mosquitoes are definitely known to transmit malaria, yellow fever, dengue and filariasis, which is often referred to as "elephantiasis." In spite of a feeling to the contrary, it is now known that there are some five or six million cases of malaria in the United States alone and according to Metcalf and Flint, there are some 10,000 or 12,000 deaths annually in the United States which are caused by malaria. It is impossible for malaria to be transmitted from one person to another without having the Anopheles mosquito act as the intermediate host to the causative agent.

Nearly all the tropical countries and the south and southeastern seaport cities are subject to yellow fever epidemics. Great mortality has resulted from these epidemics in the past, and now modern science introduces a vaccine which renders one immune to this dread disease. Yellow fever is transmitted primarily

by the mosquito Aedes aegypti which belongs to the family Culicidae, the same family to which our more common northern mosquitoes belong. We are all more or less familiar with the more common methods of mosquito control, such as swamp drainage, screening, etc. There have been developed on the commercial market a number of mosquito repellants most of which seem to have as their nucleus, oil of citronella, oil of cedar, and oil of camphor.

BUGS

AMONG THE true bugs which are detrimental to the health of man, mention will be made of but one intermittent parasite, the bedbug Cimes lectularius of the family Cimicidae. While the bedbug is primarily a nuisance by its nocturnal biting and feeding, it is quite generally thought that the bug may also be a carrier of a number of human diseases, including leprosy, bubonic plague, and relapsing fever. Fumigation of the home with hydrocyanic acid gas is very effective in controlling this insect.

MITES

This paper would be quite incomplete without some mention of the small mites which attack the health of man. One of the principal ones is the chigger mite, Trombicula irritans. They usually cause the skin to become inflamed and often they cause it to become so irritated that in some cases some slight fever has formed. The mites are not true insects as they belong to the class Arachnida to which the spiders belong rather than to the class Hexapoda to which all true insects belong. Powdered sulfur or naphthalene are both effective as repellants. However, after the mite has bitten the host and irritation has begun, some relief may be affected by applying ammonia or salicylic acid in alcohol with a little olive oil.

Note: Credit for the suggested controls in this paper must be given to Metcalf and Flint, "Destructive and Useful Insects," and to Herms, "Medical and Veterinary Entomology."

PLANT CULTURE WITHOUT SOIL

(Continued from page 14)

them in paper towels which were kept damp by repeated soakings. They were kept in a warm place and within a week all three kinds had started to germinate. After germination they were put in a small case which had the bottom covered to a depth of ¼" with cotton. The seedlings were placed upon the cotton and it was kept damp with nutrient solution. We kept the seedlings in the case until they were large enough to be transplanted to the main tank. We were able to disentangle the roots of the bean plants without very much trouble, but the roots of the radish and tomato plants were so tangled that we were obliged to transfer the cotton, plants and all, to the main tank.

We have had some trouble with our water garden. We found through experience that it is wise not to handle the plants too much. We lost several this way. We also had trouble with algae that grew in our nutrient solution. These were checked by darkening the sides of the tank and excluding the sunlight which they need.

Another system of hydroponics is known as the constant drip system. In this system the nutrient drips slowly from a source above the plant and is constantly being freshly supplied to the roots. The used solution runs out the drain at the same rate of speed. The two main advantages of this system for amateur experimenters are: it is not as bulky as a tank and the nutrient solution is constantly being freshly aerated.

These are only a few of the things that can be done with hydroponics. There are many interesting experiments that can be performed and many useful applications that can be found with this branch of science.

The Gist of It Seems to Be

Abstracts and Reference

We **enter** this war with our economic structure and morals greatly impaired by the last one, and we can expect an almost total loss of ethics to result. But these things must not be blamed on the scientists, but on those who misuse science. **Scientists are the most ethical body in the world.** They really practice the things only acclaimed by others: devotion to truth, service, and the benefit of mankind everywhere. All the basic discoveries of scientists have been for the benefit of mankind as a whole and have so resulted.—E. R. Hedrick, "Science, Ethics, and War," in S.S.&M., Feb., 1940. P. B. S.

Science teachers who are greatly interested in this topic (and who is not?) should read also an opposed point of view, "The Social Function of Science," by J. D. Bernal, Macmillan, 1939. —Ed.

* * *

Our increasingly rationalistic teaching of Physics makes it ever more and more abstract. The needed experiential background must be provided by the teacher so that physics problems will arise naturally and the scientific method will be needed and really used to discover the laws and principles of the subject.—James G. Harlow, "Formulas in Physics," in S.S.&M., Feb., 1940. P. B. S.

* * *

How to make a satisfactory photomicrography apparatus with an old camera at a total cost under $10.00.—George H. Hamilton, "Photomicrography—a Project in Biology," in S.S.& M., Feb., 1940. P. B. S.

* * *

Education 681 is a course at Ohio State University wherein students will have experience in working with such techniques as glass blowing, wood and metal working, electrical circuits and devices, photographic and visual aids as related to apparatus, materials and apparatus and tools used in science courses in secondary and elementary schools. It is a professional laboratory course that is meeting with approval by both experienced and inexperienced teachers.—G. P. Cahoon, "A Professional Laboratory Course for Science Teachers," in Sc. Ed., Feb., 1940. P. B. S.

* * *

Daily life activities involve few situations where an understanding of the principles of chemistry pertaining to electrolytes, the gas laws, the law of multiple proportions, radio activity or energy constants are applicable. The principles having the lowest ranking are not necessarily those of least importance, but are those having the least utility value when based upon an activity list.—W. P. Showalter. "An Evaluation of the Principles of Chemistry as Shown by Adult Activities," in Sc. Ed., Feb., 1940. P. B. S.

* * *

Since the real history of the world is not a story of generals and battles but a story of scientists and discoveries, the public in our democracy cannot be really intelligent without some concept of the social implications of science and technology. To sense those implications it must have some idea what science is all about and be taught to be logical in its mental processes. This puts a heavy load on the science teachers, but there is no one to whom they can shift the burden.—C. C. Furnas, "Summary of History Without Generals," in S.S.&M., Jan., 1940. P. B. S.

* * *

Here is another sure-fire demonstration to add to one's stock-in-trade of the "dry ice," liquid air, and electrostatic lectures.—H. R. Rahn, "An Alcohol Demonstration," in S.S.&M., Jan., 1940. P. B. S.

NATIONAL COMMITTEE

(Continued from page 22)

are acquired that represent habitual application of those fundamental generalizations which collectively constitute the most important informational gift of science to the world.

"This subcommittee will welcome any information that may help in its work. Broad nationwide participation in this study of science teaching problems is much to be desired."

The work of the National Committee on Science Education, though far from complete, is developing rapidly and is definitely pointing toward real achievements in all areas being studied. Due to the extensive character of the work, however, it is doubtful if the study can be completed within the coming year. With good teacher co-operation, much can be accomplished. We trust this work will be continued until well done.

JUNIOR ACADEMY PROBLEMS

(Continued from page 25)

must become resourceful in experimenting; they experience the joy of working with others and with scientists; they learn the value of being respectful-minded.

The Junior Academy of Science movement is one movement which is efficiently training the future business and professional leaders of America. We have no other course than to put our resources back of it.

PROJECTS AVAILABLE

Projects Available. Those interested may secure descriptive material covering 24 science projects from Miss E. M. J. Long of Normandy High School, St. Louis, Missouri. The material is printed in mimeograph form and the charge for it is just enough to pay for materials and postage.

BOOK SHELF

The Communicable Diseases. A. M. Stimson, 111 pages. 64 illustrations. Miscellaneous Publication Number 30, U.S. Public Health Service. Superintendent of Documents. 25 cents.

In his booklet more than forty communicable diseases are discussed in popular and yet scientifically accurate language by Dr. A. M. Stimson, Medical Director, United States Public Health Service. The clear explanation it gives of disease undoubtedly provides one of the best means of teaching students the need for individual, community, state and federal control measures.

This book brings to the school the discoveries of modern science in the prevention, cure, and social control of communicable disease. It helps one to understand the cause of the disease, how it is spread, and also how it affects the person. The book is of much value in understanding the problems of health and will help to develop in the individual a community consciousness of need for control measures.

High Schools and Sex Education. Benjamin C. Gruenberg assisted by J. L. Kaukonen. Bulletin Number 75 of United States Public Health Service. 110 pages. Superintendent of Documents. 20 cents.

High Schools and Sex Education by Benjamin C. Gruenberg is written to help the teacher of biology, general science, physiology and other high school subjects to make a sane approach to the sex problem in natural learning situations. The material best presented in each subject is suggested for the teacher and is presented so that the student may also read it himself.

There is no question but that high school students desire sex education possibly due to the fact that many parents do not help their children to understand sex and leave the matter for the schools.

The author is opposed to bringing into the school outside persons, such as doctors, to present sex discussion, as he believes this procedure sets sex education apart from the natural learning situations.

The book is well written and usable and should be in the hands of every biology and general science teacher.

Modern Methods and Materials for Teaching Science. Elwood D. Heiss, Teachers College, East Stroudsburg, Pennsylvania; Ellsworth S. Obourn, John Burroughs School, Clayton, Missouri; and C. Wesley Hoffman, Blair Academy, Blairstown, New Jersey. The Macmillan Company, New York, 1940. 351 pages. 25 illustrations. $2.50 list price.

The need for a book to guide the science teacher in better classroom practices, acquaint him with useful equipment, and provide him information as to sources of materials has been met in Modern Methods and Materials for Teaching Science.

PREPARATION OF LITHIUM

(Continued from page 15)

cools. The lithium does not take fire during this transfer because of its relative inactivity and the fact that it is coated with lithium chloride. The wire is then replaced and the current turned on again for the next globule. When enough lithium has been collected it may be cleaned with methyl alcohol. To do this the lithium is shaken up with some alcohol which dissolves the chloride, but attacks the metal but slightly.

AS TO THE current for this experiment, I have found that the best source is not a battery, but a generator. Electrolysis consumes so much current that it quickly runs a battery down. An automobile generator is suitable, but the best supply is a standard laboratory generator. A current of from 3-12 amperes and 5-12 volts is satisfactory. (The voltage stated above is only the drop in potential across the electrolysis apparatus. Because a rheostat was used in the line, the potential drop of the whole circuit was somewhat higher, and in my case it was about thirty-five volts. A globule about one-eighth of an inch in diameter was formed in from one to

three minutes — the greater the wattage, the shorter is the time.

While number 18 wire will stand quite a heavy load, a lighter wire will not, and hence a lower current must be used with a longer interval of time. A battery of four dry cells may be used, but then the globules take about eight minutes to form. One point cannot be stressed too highly, namely, that the carbon rod must be insulated from the rest of the apparatus. If this is not done, then the iron crucible becomes charged, and acts as an anode. The liberated chlorine will then attack the crucible directly, quickly destroying it. With the rod insulated, the chlorine comes in contact only with the carbon, and not with the crucible at

THE PROCEDURE already given may logically come last, but I have stated it first so that the reader may keep the whole process in mind as I discuss other experiences in preparing lithium.

My first attempt at producing lithium was rather crude. I used an ordinary porcelain crucible, heated by a Bunsen burner. Instead of the nichrome wire cathode a platinum one was used, while a six-volt battery supplied the current. The result was a complete failure, for after a globule of lithium had formed on the loop and was removed from the crucible, the lithium began to exodize and then took fire. It not only burned up but also destroyed the platinum wire. This nearly concluded the experiment, for platinum is rather expensive; but I happened to have on hand some nichrome wire used in electric heating elements, and this I substituted for the platinum. Since the nichrome wire worked quite well, I am inclined to believe that the reason the platinum wire was so unsuccessful was its fineness, being only number 26 gauge. When the lithium started burning, it generated much heat which the wire was too fine to carry away. This heat kept on building up until the platinum wire finally melted. This happened in spite of its high melting point, 1773.5° C. The nichrome wire, on the other hand, in spite of its lower melting point, 1538° C., was about number 22 gauge, a bit heavier, which permitted it to carry away the excess heat fairly well.

MY SUCCESS was short-lived, however, for no sooner had I started the experiment going again than the porcelain crucible broke. I quickly replaced it, but the new one also broke, and five crucibles were broken before I quit in disgust.

In the next attempt an iron crucible was used which proved quite satisfactory. To be sure it was oxidized by the heat, and the escaping chlorine attacked it slightly; but nevertheless it lasted a long time. Instead of a battery, which was not very adequate, I used an old automobile generator, delivering about 25 volts and 12 amperes. This worked very well. With 12 volts across the electrodes and a current of 4 amperes, a globule 1/8 inch in diameter formed in three minutes.

After the set up was moved to school, I could use the standard laboratory generator of much greater output than mine. I had no further trouble except that occasionally the molten chloride would form a depression around the carbon rod and strike up an arc, thus preventing the current from flowing. The use of a graphite rod, or one containing some graphite, tends to eliminate this. A Meker burner was used this time because its broad flame was far more adequate than the narrow Bunsen flame.

SCHOOL HEALTH SERVICE

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portunist in school health service will find educational resources within the school, on the playground, in the community health department, and in the home. The trained health worker knows their whereabouts and only requires an opportunity to expose them and demonstrate their values.